Original Article

Cholesterol Lowering Potential of Allium Sativum Essential Oil in Type 2 Diabetic Patients

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ABSTRACT

Objective: The present study analyzed the cholesterol lowering potential of Allium sativum essential oil (ASEO) in hypercholesterolemia of type 2 Diabetes mellitus (T2DM).

Study Design: Observational study

Place and Duration of Study: This study was conducted at the Department of Medicine, Faculty of Medicine and Allied Medical Sciences, Isra University Hyderabad from December 2018 to January 2020.

Materials and Methods: A sample of 79 diagnosed cases of T2DM was selected according to inclusion and exclusion criteria. 10 ml of venous blood was collected for the analysis of serum total cholesterol, blood glucose, glycated HbA1, BUN and serum creatinine. Ethical clearance of institute and informed consent were mandatory. SPSS 21.0 was used for data analysis at 95% confidence interval.

Results: Blood glucose, HbA1c, serum creatinine and blood cholesterol showed significant reductions at third and sixth months compared to baseline. Serum cholesterol at baseline, third and sixth month was noted as 215.2±72.6 mg/dl, 190.7±81.6 mg/dl and 162.8±76 mg/dl respectively (p=0.0001).

Conclusion: Allium sativum essential oil reduced hypercholesterolemia in diabetes mellitus. Allium sativum essential oil may prove helpful in treating hypercholesterolemia in diabetic patients as an adjunctive therapy for those intolerant to statin therapy.

Key Words: Allium sativum essential oil, Hypercholesterolemia, Diabetes mellitus

Citation of article: Akbar M, Munir A. Cholesterol Lowering Potential of Allium Sativum Essential Oil in Type 2 Diabetic Patients. Med Forum 2020;31(11): 7-11.

INTRODUCTION

Hypercholesterolemia is one of the most overlooked metabolic disorders in diabetics. Hypercholesterolemia is associated with atherosclerosis which is fore runner of ischemic vascular disease including the coronary artery disease (CAD). Hypercholesterolemia is an independent of CAD through atherosclerosis.[1] Strong evidence exists between CAD, hypercholesterolemia and atherosclerosis.[2-4] As Diabetes mellitus is increasing in Pakistan; hence the problem is forecasted to multiply as time passes. Currently, the problem of hypercholesterolemia is highly overlooked and neglected. Despite life style modifications and pharmacological interventions, the risk of established mortality by CAD, brain stroke and peripheral arterial disease (PAD) remains known causes of mortality and morbidity in the developing countries. Hypercholesterolemia is an established risk factor of CAD and mortality, despite this majority of patients remain negligent.[5,6] Currently, the pharmacological interventions include the HMG-coA reductase inhibitors. However, they are not much effective despite side effects such as; neuropathy, myopathy and myalgias, muscle weakness, cognitive dysfunction and Diabetes mellitus.[7] Allium sativum (AS) is publicly known as Garlic. AS is a rich source of biologically active compounds used in folk medicine since time immemorial. It is rich in allicin which is a sulfur containing compound. Majority of biological activities of AS are attributed to its active ingredient the *allicin*. They include the anti-oxidant, anti-hypercholesterolemia, anti-hyperglycemia, anti-hypertensive, and anti-thrombotic activities.[8-10] Allium sativum is used in folk medicine since ancient era of 1550 BC. Allium sativum is used as taste enhancer and food flavor. Allium sativum is herb with multiple biological functions. It is used for headache, cancer and cardiac diseases. Allicin exerts bactericidal and fungicidal activity. Allium sativum increases good cholesterol (HDLc) and reduces bad cholesterol (LDLc). One proposed mechanism of anti hyperlipidemic action is through inhibition of HMG CoA reductase.[11] Allium sativum stimulates the phagocytosis by macrophages and lymphocyte

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Received: April, 2020
Accepted: August, 2020
Printed: November, 2020

functioning. [12,13]

Allium sativum is reported of its hepatoprotective, anti-oxidant, Immunomodulatory function, anti-thrombotic, anti-hypoglycemic and anti-hypertensive efficacy.[14] The primary objective of present study was to analyze the effects of Allium sativum essential oil (ASEO) on hypercholesterolemia of Diabetes mellitus. Secondary objectives were to observe effects of ASEO on the systemic blood pressure, blood glucose, glycated HbA1 and serum creatinine.

MATERIALS AND METHODS

The study was designed as an observational study that analyzed the effects of ASEO primarily on blood cholesterol, blood glucose, HbA1c, systemic blood pressure and serum creatinine. The study was conducted at the Faculty of Medicine and Allied Medical Sciences, Isra University Hyderabad from December 2018 to January 2020. Diabetic subjects attending the Diabetic clinic and Medicine OPD were negotiated about purpose of study. Eventually, a sample of 79 T2DM subjects was selected by non-probability purposive sampling who promised of regular drug intake and regular follow ups. Inclusion criteria were diagnosed cases of T2DM with blood cholesterol > 200 mg/dL, diabetes duration of ≥10 years, both genders and age between 40 – 60 years. Diabetics with history of tobacco smoking, high fiber diet such as Ispaghol husk, pregnancy, contraceptive procedures, and lipid lowering drugs were strictly excluded. Major systemic disease like chronic liver disease, pulmonary tuberculosis, diabetic kidney disease (DKD), menopause, vitamin therapy, malabsorption, and coronary artery disease were also exclusion criteria. Subjects were informed in detail about the purpose of study; its advantages and disadvantages and were asked for willingness. Drug intake and regular follow ups were emphasized again. They were informed that they are free to enter or not in the study protocol and this will not affect their treatment. They were informed that they have to allow for 5-10 ml of venous blood sampling for 3 times at baseline, at 3rd and 6th months respectively. Only willing volunteers were allowed to enroll in study protocol. Patient's biodata, medical history was asked by a medical officer and recorded on a pre structured proforma. Medical officers were informed to abide by the inclusion and exclusion criteria strictly. Participants were finally examined by a Consultant Physician. Signing consent form is mandatory. Systemic blood pressure was recorded as per criteria set out by JNC VIII.[15] Diabetes mellitus was defined as (FBG) ≥ 126mg/dl or postprandial blood glucose (RBG) ≥200 mg/dl as per ADA criteria.[16] Soft gel of Allium sativum essential oil (ASEO) containing 13.5 mg each was given once a day orally for six months. Garlish oil soft gels were purchased forms Pharmacy (High Q International Pharmaceuticals Karachi). Blood glucose was detected by "*glucose oxidase*" and HbA1c by assay method on Hitachi 902, Roche analyzer.[17] Serum creatinine and BUN were estimated by standard biochemical methods. Serum total cholesterol was detected by colorimetric method. Ethical clearance of institute and informed consent were mandatory. Confidentiality of patient data ensured. SPSS 21.0 was used for data analysis. Chi square test was used for gender analysis. Age was analyzed by one sample t-test. Paired test was used for analysis of variables at baseline, third and sixth months. P-value of ≤0.05 was statistically significant.

RESULTS

A sample of 79 T2DM subjects was studied to analyze the effects of ASEO on blood cholesterol, glycemic control, systemic blood pressure and serum creatinine in type 2 Diabetic subjects. Mean ± SD age of T2DM subjects was 41.7±8.6 years in our study population. Male and female were noted as 53 (67.1%) and 26 (32.9%) respectively. Male predominated with male to female ratio of 2.03:1. Statistical analysis of body weight, systolic BP, diastolic BP and BUN showed non-significant results at 3rd and 6th months ($p<0.05$) (table 1). Blood glucose, HbA1c, serum creatinine and blood cholesterol showed significant results at 3rd and 6th months compared to baseline. Blood glucose (R) at baseline, 3rd and 6th months was noted as 220.1±65.3, 206.6±70.7 and 181.6±63.4 mg/dl respectively (p=0.0001). HbA1c was 10.3±2.2% at baseline, which reduced to 9.7±1.8 at 3rd month and further decreased to 9.01±2.3% at 6th month (p=0.001). Serum creatinine (Scr) at baseline, 3rd and 6th months was noted as 1.03±0.23, 0.94±0.18 and 0.80±0.08 mg/dl respectively (p=0.009). Serum cholesterol at baseline was 215.2±72.6 mg/dl, which reduced to 190.7±81.6 mg/dl and further reduced to 162.8±76 mg/dl at sixth month (table 2).

Table No.1: Characteristics and laboratory findings of study subjects

	Baseline	3rd month	6th month	p-value
Age (years)	41.7±8.6	-	-	0.001
Male	53 (67%)	-	-	0.0001
Female	26(32.9%)	-	-	
Body weight (kg)	74.8±11.0	75.0±10.8	74.6±11.0	0.91
Systolic BP (mmHg)	146.4±20.2	145.4±20.0	146.4±20.1	0.92
Diastolic BP (mmHg)	86.6±14.2	87.2±14.0	87.0±14.0	0.79
Blood glucose (R) (mg/dl)	220.1±65.3	206.6±70.7	181.6±63.4	0.0001
Glycated HbA1 (%)	10.3±2.2	9.7±1.8	9.01±2.3	0.0001
BUN (mg/dl)	11.9±0.73	11.7±0.69	11.03±0.70	0.89
Serum creatinine (mg/dl)	1.03±0.23	0.94±0.18	0.80±0.08	0.009

Table No.2: Serum cholesterol levels

Serum Cholesterol (mean ± SD (mg/dl)		
Baseline	3rd month	6th month
219.2±42.5	199.5±31.6	172.5±26.1
P=value		
Baseline vs. 3rd month P=0.0003	3rd month vs.6th month P=0.0007	Baseline vs. 6th month P= 0.0001

DISCUSSION

The present study was undertaken to establish the efficacy cholesterol lowering efficacy of ASEO hypercholesterolemia of Diabetes mellitus. The present study reports a significant reduction in blood glucose, HbA1c, serum creatinine and blood cholesterol at third and sixth months compared to baseline. Serum cholesterol at baseline was 215.2±72.6 mg/dl, which reduced to 190.7±81.6 mg/dl and further reduced to 162.8±76 mg/dl at sixth month (table 2). Similarly, a decrease in blood glucose, HbA1c and serum creatinine was observed. The present study reports an improvement in glycemic control and anti-hypercholesterolemia effect of ASEO. Finding of hypercholesterolemia effect is in keeping with previous studies[18,19] Previous studies[20-23] reported total cholesterol was reduced in Diabetic subjects with hypercholesterolemia; the findings support the present study. The previous studies[22,23] concluded that the inhibition of HMG-CoA reductase is responsible for its hypocholesterolemia effect. Other previous had also reported anti hyperlipidemic effects of Allium sativum.[24,25] Other proposed mechanism of hypocholesterolemia is through the inhibition of lipoprotein lipase.[19, 20, 23,26] A recent study by Lachhiramka et al[27] reported mean cholesterol levels were reduced from baseline 265 ± 16.7 mg/dL to 232.7 ± 11.2 mg/dL third month (90th day) at 3gram raw garlic dose orally daily ($P < 0.001$). Finding of above study are in parallel to present study as the serum cholesterol was reduced significantly (table 2). A meta-analysis of 39 studies showed anti hypercholemic and anti hyperlipidemic effects of Allium sativum.[28] This supports the findings of the present study. Our finding of improvement in glycemic control (Blood glucose and HbA1c) is in agreement with previous studies.[19,22] Previous studies had reported on the improvement in glycemic control and anti hypercholesterolic effects in Allium sativum fed patients.[28-30] Anti hypercholemic and anti hyperlipidemic effects of Allium sativum of present study are also consistent with animal studies.[31,32] However, interventional clinical studies have reported positively on the anti-hypercholesterolemia and anti hyperlipidemic effects of Allium sativum.[33-35] The present study did not observed any anti-hypertensive effects of ASEO which is in contradistinction to previous studies.[24-26] Previous studies[24,25] reported anti-hypertensive effects of ASE. Another previous study reported Allium sativum reduces Diastolic blood pressure (DBP).[36] This contradistinction might be due to different study subjects of various studies such as the present study selected Diabetics while above studies selected non diabetic hypertensive population. The present has certain limitations first; small sample size, second; total lipoproteins were not estimated which might have produced effect on complete lipid profile and third; dietary factors might have affected the results towards alternate hypothesis. The findings of anti-hypocholesterolemia, improved glycemic control and serum creatinine were evaluated in prospective design; hence they are worth to report. However, the findings are worth to report as the Allium sativum is easily available, palatable and inexpensive which may be used even as home remedy. The strength of study lies in its participants who showed regular follow ups and regular use of drug. Allium sativum essential oils (ASEO) is purified compared to raw garlic used by previous studies hence our findings should be interpreted in proper clinical context. The findings of present cannot be generalized to other populations.

CONCLUSION

The present study reports Allium sativum essential oil improves hypercholesterolemia and hyperglycemic in diabetic subjects. Allium sativum essential oil may prove helpful in treating hypercholesterolemia in diabetic patients as an adjunctive therapy for those intolerant to statin therapy. However, the present study is a preliminary report conducted on a small number of diabetics, hence large sample elaborate studies may be conducted to substantiate the use Allium sativum essential oil.

Author's Contribution:

Concept & Design of Study:	Muhammad Akbar
Drafting:	Akram Munir
Data Analysis:	Akram Munir
Revisiting Critically:	Muhammad Akbar, Akram Munir
Final Approval of version:	Muhammad Akbar

Conflict of Interest: The study has no conflict of interest to declare by any author.

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